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16. Abstract

This report summarizes the research efforts of using finite element modeling and simulations to evaluate the performance of W-beam guardrails and cable median barriers on six-lane, 46-foot median divided freeways. A literature review is included on performance evaluation of W-beam guardrails and cable barriers as well as applications of finite element modeling and simulations in roadside safety research.

The three types of barriers evaluated in this project are the single-face W-beam, double-face W-beam (two designs), and generic low-tension cable barrier. All three types of barriers were evaluated at three impact speeds and three impact angles. Full-scale crash simulations were first performed on a single-face W-beam guardrail placed on the border of a 2.5:1 slope and the shoulder. Two designs of a double-face W-beam guardrail, which replaced the single-face W-beam at the same location, were then evaluated using simulations and compared to the single-face one. Finally, simulations were performed on vehicles impacting the cable median barrier placed on a 4:1 slope. The simulation results demonstrated the effects of sloped medians on vehicle redirection after contacting the cable median barriers or W-beam guardrails. A common issue for a sloped median is the increased potential of vehicle rollovers, particularly for large-size vehicles. The results will be used to update and validate the standard drawings and strategies for placement of median guardrails and cable barriers.

The use of finite element simulations is shown to be both effective and efficient, because they are nondestructive, repeatable, modifiable, and inexpensive. Furthermore, finite element simulations can be used to study crash scenarios that are impossible and/or extremely expensive to conduct physical crash testing. Finite element modeling and simulations are recommended for future investigations of other research issues.

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